Country Profiles Regarding the Use of Imported Dairy Bulls

Dürr, J.W. and Jakobsen, J.H.
Interbull Centre, SLU , Animal Breeding and Genetics,
Box 7023, 750 07 Uppsala, Sweden; joao.durr@hgen.slu.se

Abstract

Interbull currently provides international genetic evaluation services for 29 countries, divided in 73 populations of 6 different dairy breeds and involving 38 different traits. Most of the international trading of dairy genetics refers to animals that have been evaluated at Interbull in order to be marketed in several countries. It is safe to assume that the multi-country pedigree file at Interbull is one of the most complete sources of information in global animal breeding of any species. Therefore, an analysis of both importing and exporting countries profiles from Interbull pedigree is proposed. A total of 180,617 bulls with official national evaluations were included and among those 37,256 were identified as foreign bulls by the reporting country (same bull may have been reported by different importing countries). This represents that 20.6% of dairy bulls worldwide are imported. Cluster analysis was applied in data from six dairy breeds to group countries according to two criteria: ratio between number of imported bull by country of origin and total number of bulls reported, and ratio between number of imported bulls by country of origin and total number of imported bulls. Methodology allowed clear distinction between heavy, medium and small importers and also indicated the country profiles regarding the preferred origin of the imports. Red dairy breeds practice the lowest amount of trading (7.8%), while Holstein is the breed with the largest proportion of imported bulls (24.9). US are consistently the largest exporters of dairy genetics across all but Simmental and the red breeds, followed by the Netherlands, Canada, Germany and France. Heavy importers (more than 80% of imported bulls in at least one breed) were Belgium, Canada, Germany, Ireland, Italy, the Netherlands, New Zealand and Slovakia. Groups created by the cluster analysis showed that importing country profile is influenced by region and production system.

1. Introduction

Interbull is a non-profit organization within the International Committee for Animal Recording (ICAR) dedicated to provide the dairy breeding industry tools for the establishment of international fair trading. Besides international standards for validation of national genetic evaluations, Interbull also provides international genetic evaluation services for 29 countries, divided in 73 populations of 6 different dairy breeds and involving 38 different traits. Most of the international trading of dairy genetics refers to animals that have been evaluated at Interbull in order to be marketed in the participating countries. It is safe to assume that the multi-country pedigree file at Interbull is one of the most complete sources of information in global animal breeding of any species, reflecting very well the genetic ties between populations through the common ancestors shared across frontiers. The study of Interbull pedigree indicates the major suppliers and the major consumers of dairy genetics within each breed. Therefore, an analysis of both importing and exporting countries profiles from Interbull pedigree is proposed here, in an attempt to capture the recent scenario in dairy genetics trading.

2. Materials and Methods

Table 1 shows that a total of 180,617 bulls with official national evaluations were included in the study and among those 37,256 were identified as foreign bulls by the reporting country (same bull may have been reported by different importing countries). This represents that 20.6% of dairy bulls worldwide are imported. Figure 1 describes the data included in terms of bulls per breed and birth year. Holstein and Simmental are clearly the most numerous and Guernsey the least numerous among the breeds represented in the Interbull pedigree. Observed reduction in

numbers of bulls in 2003 and 2004 is a simple truncation effect. Figure 2 discriminates the country of origin among the bulls reported as imported by the countries. It is evident that the major supplier of dairy genetics (all breeds but Simmental and red breeds) is the USA, followed by the Netherlands (only Holstein) and Canada.

Cluster analysis using Ward's hierarchical clustering method (Ward, 1963) was applied to data from six dairy breeds to group countries according to two criteria:

$$AIR = \frac{NI}{GT} \quad \text{and} \quad RIR = \frac{NI}{TI}$$

where AIR = absolute importation ratio, NI = number of imported bulls **by country of origin**, GT = grand total number of bulls reported, RIR = relative importation ratio and TI = total number of imported bulls.

The statistical analyses were performed using SAS (2009).

Table 1. Number of bulls included in the study per breed of evaluation.

Breed	Total number of bulls	Total number of imported bulls	% Imported bulls
Brown Swiss	9279	1590	17.1
Guernsey	1160	247	21.3
Holstein	123619	30777	24.9
Jersey	10269	1737	16.9
Red Dairy Cattle	12438	966	7.8
Simmental	23852	1939	8.1
Total	**180617**	**37256**	**20.6**

3. Results and Discussion

Figure 3 illustrates how the results from the hierarchical clustering of AIR where interpreted using the Holstein breed as example. The clusters could be clearly distinguished in the dendrogram and countries were ordered accordingly in the chart showing absolute proportion of imported Holstein bulls by country of origin. This procedure allowed the characterization of each cluster formed (Table 2). Similarly, Figure 4 shows the results from the hierarchical clustering of RIR, also for the Holstein breed. The characterization of clusters for RIR is made in Table 3. Dendrograms and charts with proportions are not shown for the other breeds, but the characterizations of the clusters are included in Tables 2 and 3.

As a summary of the results, it is possible to say that methodology used in this study allowed clear distinction between heavy, medium and small importers and also indicated the country profiles regarding the preferred origin of the imports. Red dairy breeds practice the lowest amount of trading (7.8%), while Holstein is the breed with the largest proportion of imported bulls (24.9%). USA are consistently the largest exporters of dairy genetics across all but Simmental and the red breeds, followed by the Netherlands, Canada, Germany and France. Heavy importers (more than 80% of imported bulls in at least one breed) were Belgium, Canada, Germany, Ireland, Italy, the Netherlands, New Zealand and Slovakia. As a general trend, the clusters formed group countries that either are from the same geographical region or have similarities in their dairy farming production systems, which would logically influence their choices of imported bulls.

Table 2. Characterization of the clusters formed in the absolute importation ratio (AIR) analysis.

Breed	Clusters*	% Imported bulls	Main Origin (decreasing order)
Brown Swiss	NDL, CAN, NZL	65-85	USA
	FRA, ITA, SVN, CHE, DEU, USA	5-40	USA, DEU
Guernsey	NZL, CAN, AUS	60-90	USA
	GBR, ZAF, USA	0-30	USA
Holstein	AUS, NZL, NLD	25	USA, CAN
	DEU, DFS, ISR, ITA, FRA, POL,USA	5-25	USA, NLD, CAN
	CAN, ZAF, CHE, ESP, CHR, HUN, GBR	30-50	USA, CAN, NLD
	CZE, EST, SVN, LVA, SVK	50-80	USA, DEU, NLD, CAN
	JPN	65	USA, CAN
	BEL, IRL, FRR	65-95	NLD, DEU, Other, USA
Jersey	DEU, ITA, NLD	90	DNK, USA
	ZAF, AUS, CAN	40	USA, NZL
	GBR	30	USA, DNK, CAN
	NZL, USA, DNK	<10	-
Red Dairy Cattle	ZAF, USA	25-55	CAN
	AUS, CAN	20-40	USA, SWE, CAN
	NZL, GBR	10-20	CAN
	DEU, DFS, NOR	0-5	-
	EST, LVA	20-25	DNK
Simmental	FRA_M, DEU, CHE	0-15	-
	HUN, SVN, CZE, FRA_S, ITA	20-40	DEU
	SVK	60	DEU
	IRL, NLD	>90	FRA

*Country codes follow ISO international standards, except for CHR (Red Holstein from Switzerland), DFS (Denmark+Finland+Sweden), FRA_M (Montbeliard from France), FRA_S (Simmental from France) and FRR (Red Holstein from France).

Table 3. Characterization of the clusters formed in the relative importation ratio (RIR) analysis.

Breed	Clusters*	Description
Brown Swiss	NDL, FRA, CHE, DEU	USA is the main supplier but DEU and ITA are also important
	SVN, ITA	DEU is the main supplier
	USA	ITA is the main supplier
	CAN, NZL	USA supplies 90% of imported bulls
Guernsey	CAN, GBR, ZAF, AUS, NZL	USA supplies 55 to 100% of imported bulls
	USA	Do not import
Holstein	AUS, NZL, ZAF, NLD	USA supplies 40-50% of imported bulls
	CHE, CHR, ESP, FRA, GBR	USA supplies 30-40% of imported bulls CAN (25-30%) and NLD (5-30%) are also important
	BEL, DEU, IRL, ISR	NLD supplies 40% of imported bulls USA supplies 10-50% of imported bulls
	CZE, POL, DFS, ITA, EST, SVN, HUN, LVA, SVK	USA, NLD, DEU supply 30% of imported bulls each
	FRR, USA	75% of imports come from one country (DEU and CAN, respectively)
	CAN, JPN	USA supplies >90% of imported bulls
Jersey	CAN, DNK, AUS, NZL, ZAF	USA supplies 70-95% of imported bulls
	GBR, NLD	USA (50-60%) and DNK (30%) are the main suppliers
	ITA, DEU	DNK supplies 50-60% of imported bulls USA supplies 40% of imported bulls
	USA	CAN supplies 70% of imported bulls
Red Dairy Cattle	CAN	USA supplies 90% of imported bulls
	NOR, DEU	SWE supplies 65-80% of imported bulls
	NZL, AUS	SWE and FIN are the major suppliers
	EST, LVA	DNK (60%) and SWE (10-30%) are the major suppliers
	USA,GBR, ZAF, DFS	CAN supplies 55-80% of imported bulls USA supplies 20-30% of imported bulls
Simmental	CHE, DEU	FRA supplies 30-35% of imported bulls
	FRA_M	DEU and ITA supply 30% of imported bulls each
	NLD, IRL	FRA supplies 75-100% of imported bulls
	FRA_S, SVK, SVN, HUN	DEU supplies 65-80% of imported bulls AUT supplies 10% of imported bulls
	ITA, CZE	DEU (50%), FRA (30%) and AUT (10-15%) are the major suppliers

*Country codes follow ISO international standards, except for CHR (Red Holstein from Switzerland), DFS (Denmark+Finland+Sweden), FRA_M (Montbeliard from France), FRA_S (Simmental from France) and FRR (Red Holstein from France).

4. Conclusions

USA is the major supplier of imported bulls worldwide, except for the Simmental and the red dairy breeds. Groups created by the cluster analysis showed that importing country profile is influenced by region and production system.

5. References

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Ward, J.H., Jr. 1963. Hierarchical grouping to optimize an objective function. *J. Amer. Stat. Ass. 58*, 236–244.

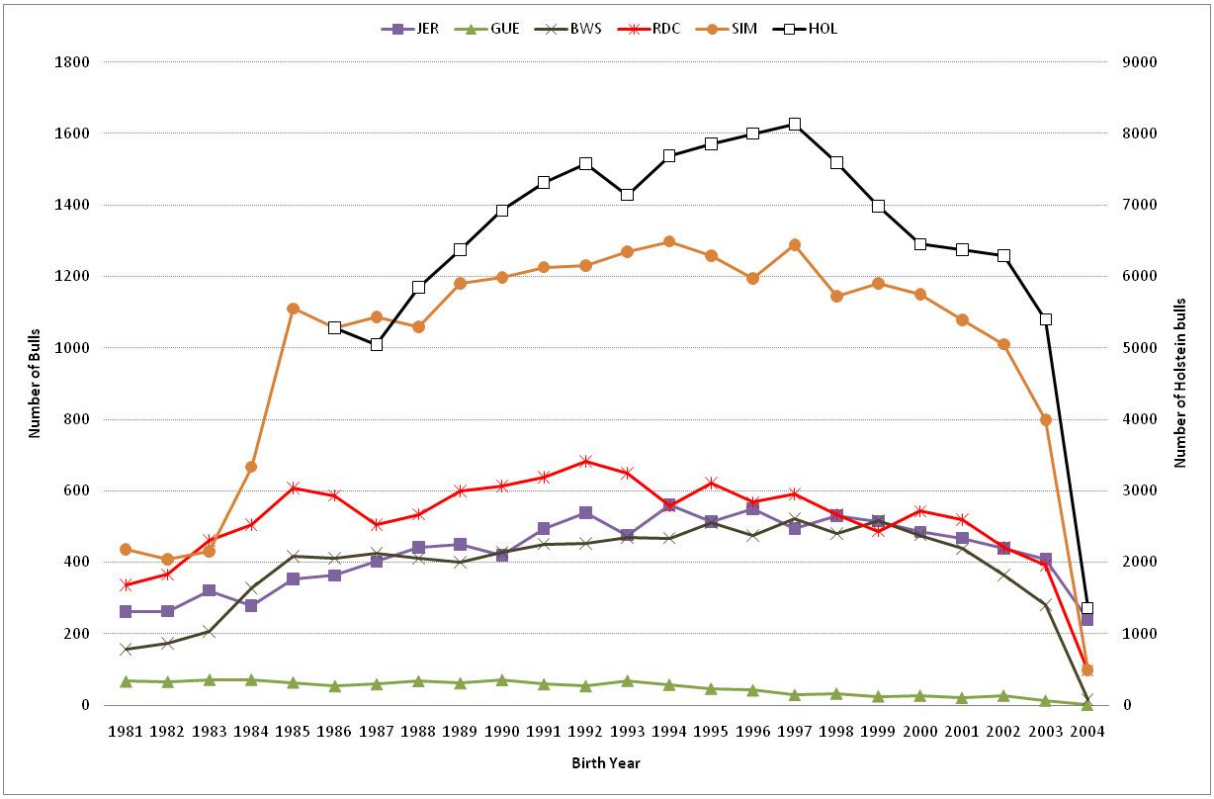

Figure 1. Bulls included in the study by breed and year of birth.

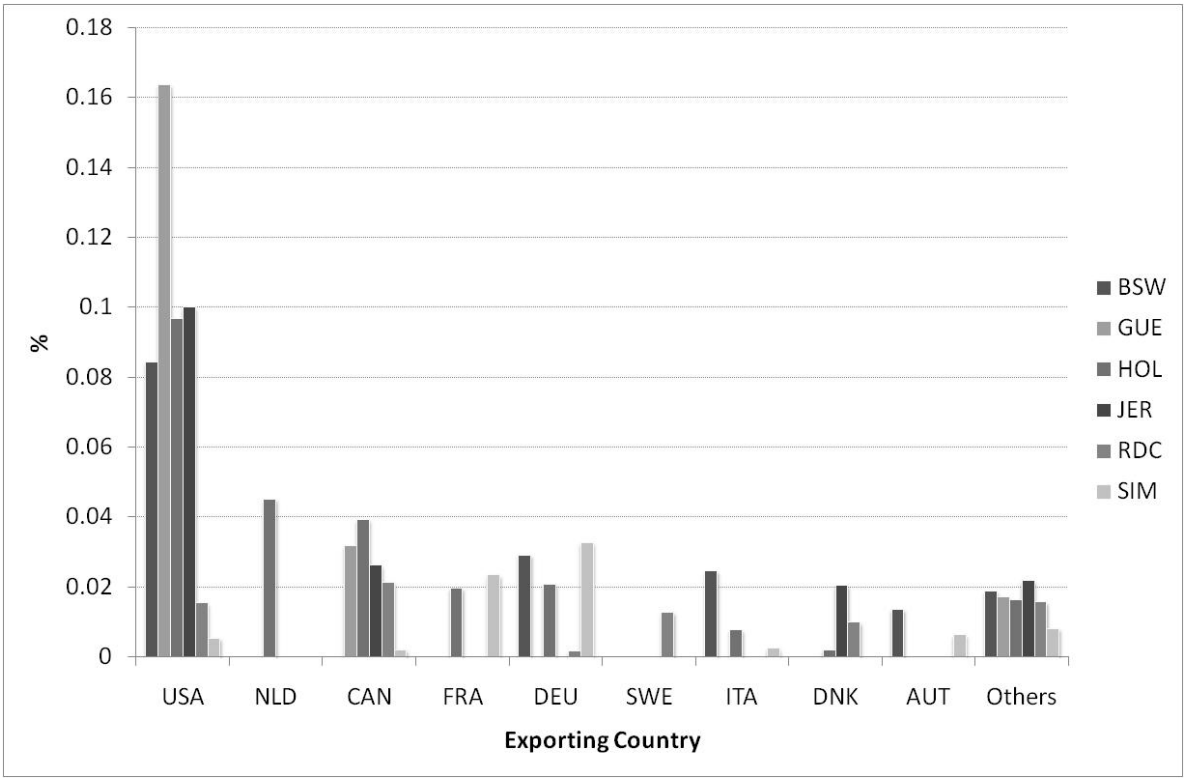

Figure 2. Proportion of imported bulls by country of origin and breed.

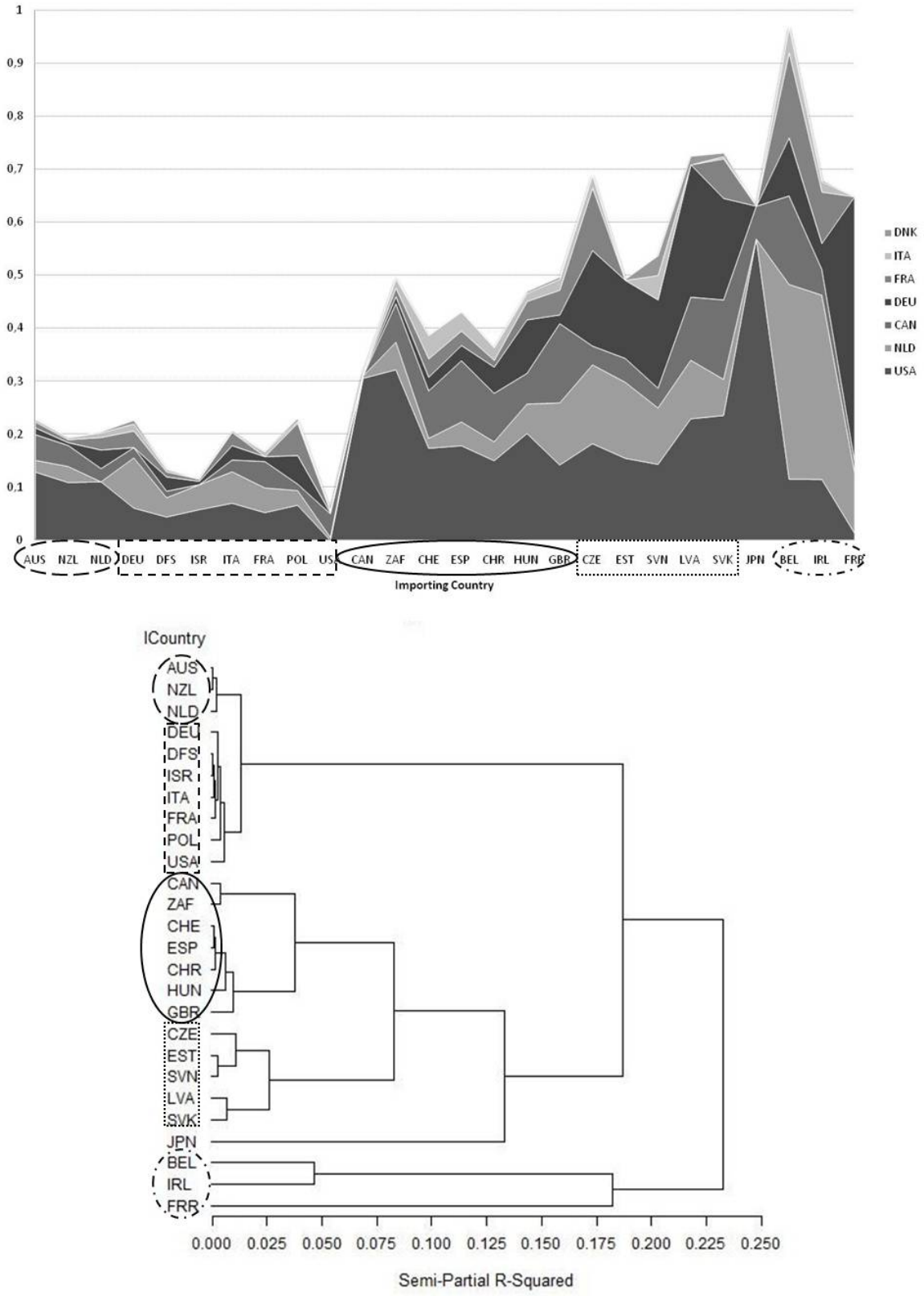

Figure 3. Dendrogram from hierarchical clustering analysis of the absolute importation ratio (AIR) for Holstein bulls and the respective absolute proportion of imported Holstein bulls by country of origin. Groups of countries formed in the cluster analysis are highlighted in the chart of absolute proportions.

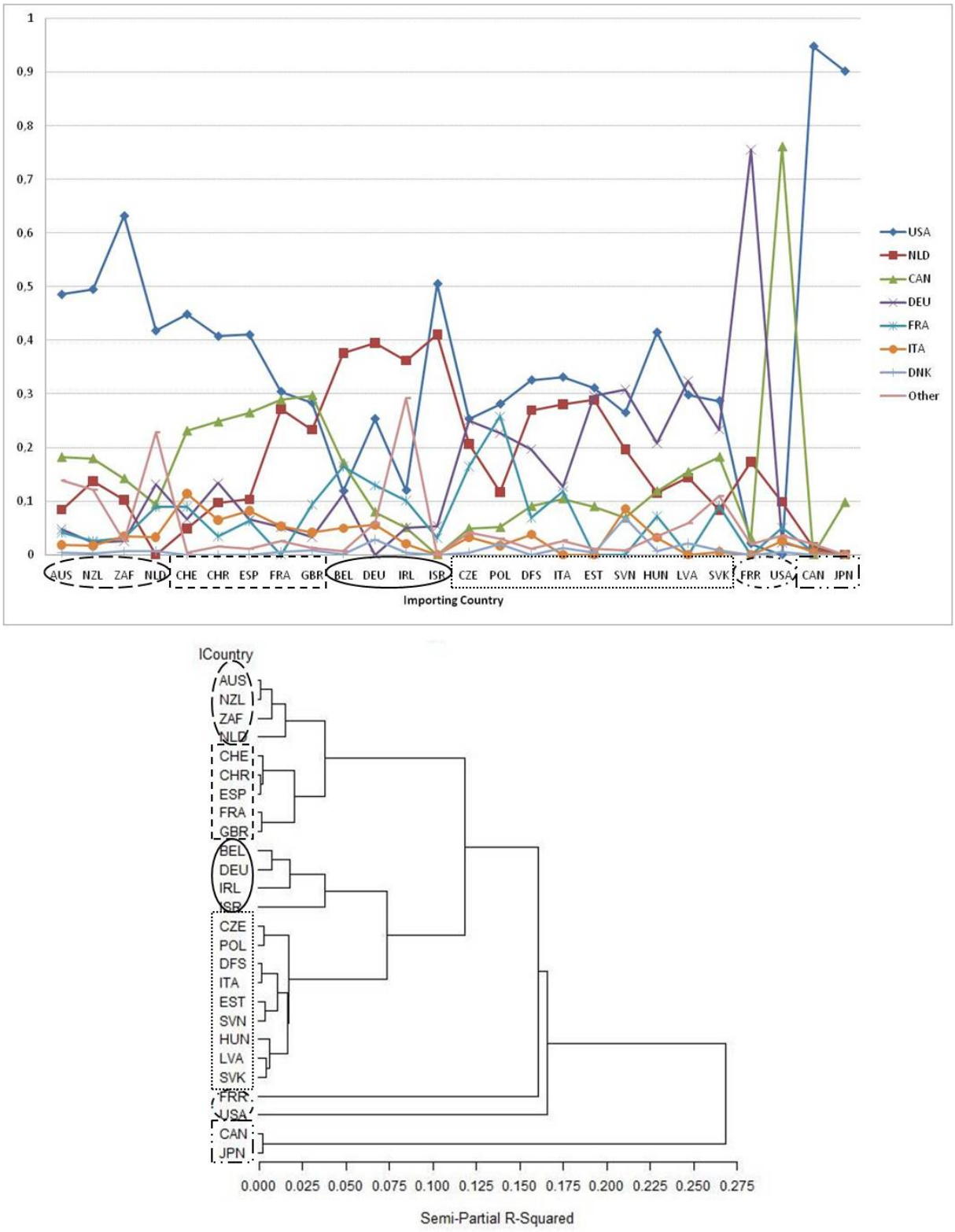

Figure 4. Dendrogram from hierarchical clustering analysis of the relative importation ratio (RIR) for Holstein bulls and the respective relative proportion of imported Holstein bulls by country of origin. Groups of countries formed in the cluster analysis are highlighted in the chart of relative proportions.